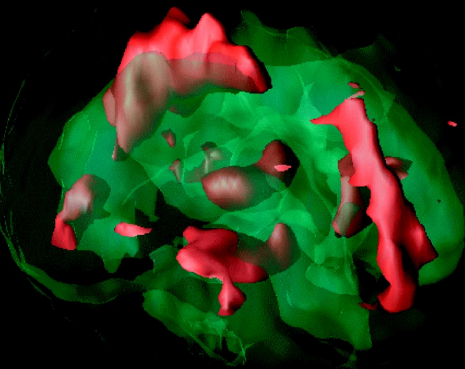


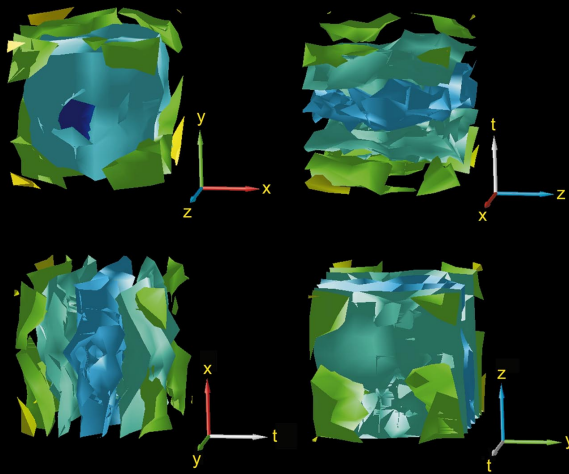
Medical Imaging

Positron Emission Tomography images document the real-time evolution of the drug cocaine in the human brain. A study using thirty subjects established that the subjective 'high' experienced by drug abusers is produced when the cocaine molecule blocks dopamine re-uptake channels in the axons of the basal ganglia.



Nuclear Physics

Selected frames from the simulation of a collision of two gold nuclei in the Relativistic Heavy Ion Collider (RHIC), forming a quark-gluon plasma, a state of matter thought to exist shortly after the Big Bang. The plasma is highly unstable and decays into prehadronic nuclei which then decay into detectable particles. The time scale is 10^{-24} seconds. Shown at the left is the probability of finding a pion at a given location and time. Four 3-D projections show this 4-dimensional quantity, which is used to calculate particle properties such as mass. Data were calculated from fundamental Quantum Chromodynamics using the RIKEN BNL Research Center's QCDSF supercomputer (12,288 nodes, .6 Teraflops).



Scientific Visualization at



Brookhaven National Laboratory (BNL) is a U.S. Department of Energy (DOE) scientific research laboratory located on Long Island, New York. As a non-defense research institution, BNL is dedicated to basic and applied investigation in a multitude of scientific disciplines.

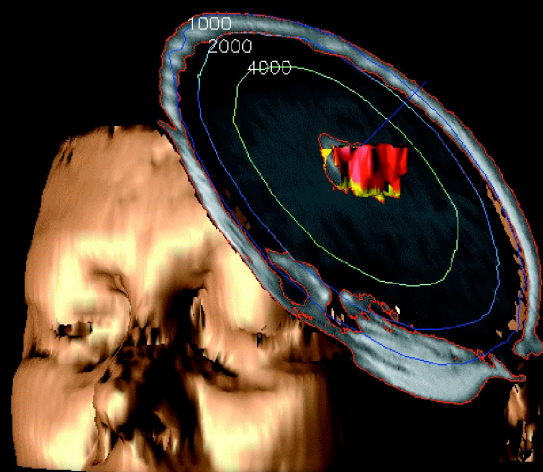
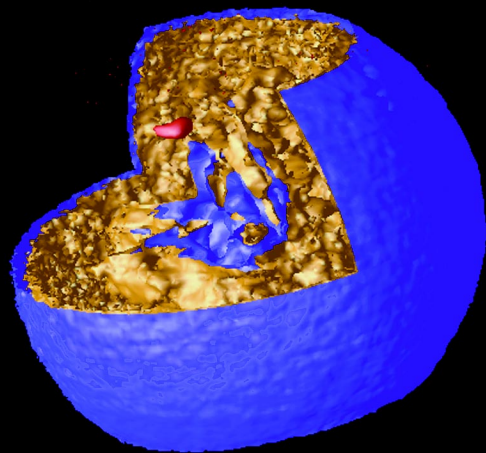
Experimental and theoretical physics, medicine, chemistry, biology, environmental research, engineering and many other fields are represented here by our 3,200-member staff and over 4,000 visitors who come to BNL every year to use our world-class facilities.

The Information Technology Division (ITD) works closely with BNL's scientific departments and other

divisions to provide high quality service in computing, networking and telecommunications. The Stereoscopic Visualization Theatre and the projects represented here are but a part of ITD's efforts to support research and industrial partnerships at BNL.

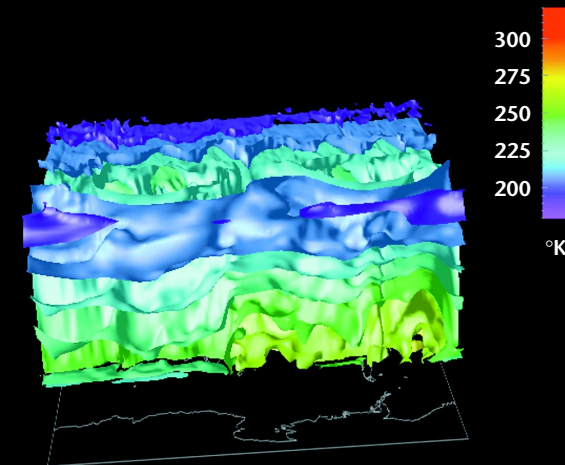
For more information contact:
Thomas Schlager
Information Technology Division
Brookhaven National Laboratory
Upton NY 11973-5000
(631) 344-2890 schlager@bnl.gov

<http://www.itd.bnl.gov/visualization/>



X-Ray Computed Microtomography (Medical)

A microtomography facility at the Brookhaven National Synchrotron Light Source (NSLS) combines rapid image reconstruction using high speed parallel computing resources, with theoretical modeling and high-bandwidth networking. Three-dimensional volumes with a spatial resolution of two microns are used as input to quantitative calculations to improve our knowledge in a variety of disciplines. Shown below is a section (approx. 1mm across) from a thigh bone of a rat suffering from osteoporosis. The porous nature of the bone's central portion is indicative of the disease. Laboratory studies on rats expedite finding treatments for humans, but the small bone size necessitates high resolution X-ray imaging.

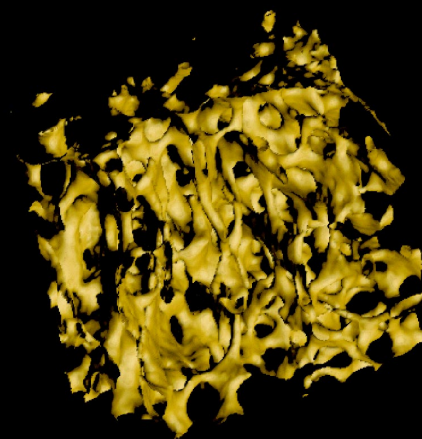


X-Ray Computed Microtomography (Astrophysics)

A microtomography facility at the Brookhaven National Synchrotron Light Source (NSLS) combines rapid image reconstruction using high speed parallel computing resources, with theoretical modeling and high-bandwidth networking. Three-dimensional volumes with a spatial resolution of two microns are used as input to quantitative calculations to improve our knowledge in a variety of disciplines. Shown above is a micrometeorite (0.2 mm diameter) with its outer surface (blue) cut away. The red mass at the upper left is a platinum nugget.

Radiotherapy Treatment Planning

Boron Neutron Capture Therapy is an experimental radiotherapy for treating intractable malignancies. It requires treatment planning procedures designed to predict the dose delivered to the cancerous and normal tissues. This technique uses three-dimensional correlation of segmented MRI volumes with 3D Monte Carlo radiation transport calculations of the differential dose distributions produced by neutron irradiation.

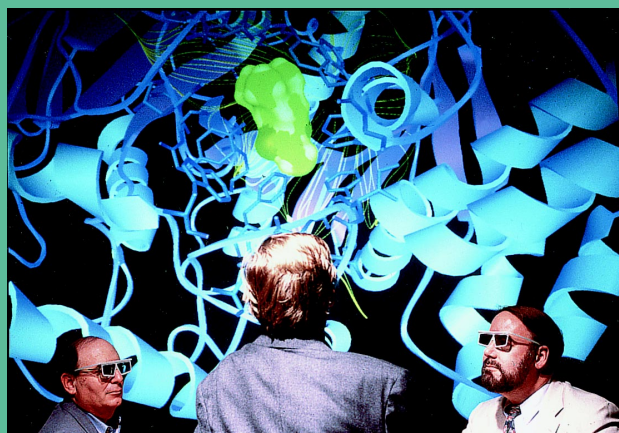


Environmental Science

Shown above are the results of a global weather simulation used to study the effects of wind and temperature on aerosol concentrations in the atmosphere. Nine isosurfaces of temperature (degrees Kelvin) are shown – colored violet to blue to red in order of increasing temperature. Animations of the simulated temperature show realistic features over the southern hemisphere, including a temperature increase over water near Antarctica, cooling and counter rotation in the upper atmosphere.

Stereoscopic Visualization Theatre

The centerpiece of visualization at Brookhaven is a novel stereoscopic viewing system. Constructed and maintained by the Information Technology Division (IT D), this facility is available to all research groups at BNL. The display system is driven by a Silicon Graphics Onyx2 rack system. The stereo effect is achieved in a conference room setting by projecting two polarized images on a specially designed 10 foot screen (treated to retain light polarization), then viewed through polarized glasses.



The viewing algorithm makes the image of the object appear to float into the center of the room. The 1280x1024 resolution produces an exceptional image quality. The system was designed for ease of replication and high-speed network interaction. Among the application tools currently used are the Silicon Graphics Performer API, and IBM Visualization Data Explorer.

This facility differs from others primarily in that it provides high-resolution stereographic viewing for up to 30 individuals at once; it does not require the viewer to wear head mounted electronics, either shutter mechanisms or head tracking devices, in order to participate. The degree of realism and sense of immersion provides a viewing experience comparable to that of far more expensive technologies.